

Meaning and structure of prokaryotic chromosomes

The Genome of a prokaryote is usually made up of one chromosome and plasmids. Eukaryotes, on the other hand, contain a larger number of chromosomes – both nuclear and extranuclear (mitochondrial) – and sometimes plasmids.

Most of what we know about prokaryotic chromosomes has been obtained from studies *E. coli* – this is the organism of choice for similar research on prokaryotes. A chromosome is made up of double-stranded circular DNA. Prokaryotes do not contain a nucleus or other membrane-bound organelles. The word "prokaryote" actually means "before the nucleus". The chromosome is stored in a special region called the nucleoid.

The genome of a prokaryote is often significantly larger than the cell itself. So how is it possible for genetic information to fit into a cell? Eukaryotes solve this problem by wrapping DNA around histones. However, prokaryotes do not contain histones (there are a few exceptions). A prokaryote compresses its DNA by coiling the filament into small coils (supercoiling) (<http://www.nature.com/scitable/topicpage/genome-packaging-in-prokaryotes-the-circular-chromosome-9113>). The fibers are twisted so tightly that eventually the loops overlap and form one large condensed ball. It distinguishes between two types of packing – positive (the turns of the DNA are in the same direction as the helix) or negative (the DNA is twisted in the opposite direction to the helix). Most bacteria during normal growth are negatively coiled.

Specific properties of prokaryotes

Prokaryotes most often reproduce asexually and are haploid (there is only one copy of a gene at a time). Prokaryotes often also contain several plasmids (extrachromosomally stored DNA molecules of a linear or circular nature). Compared to chromosomal DNA, they are typically smaller and encode genes that are not necessary for survival. However, they often give their wearer some advantage (eg: resistance to ATB,...). Plasmid replication occurs independently of chromosome replication.

Due to the need for prokaryotes to fit all their genes into a single chromosome, there is not much room left for non-coding sequences. Although in eukaryotes the share of non-coding DNA segments is around 98%, in prokaryotes it is only 12%.

Chromosomes of prokaryotes

- most prokaryotes contain one circular chromosome
- chromosomes are stored in the nucleoid, in which they fit due to the coiling of the DNA strand and binding to some proteins
- DNA communicating with the cytoplasm allows direct connection of transcription and translation
- contain only one copy of the gene (monoploid)
- non-essential genes are usually stored in plasmids outside the chromosome
- the prokaryote genome is very compact - containing very few non-coding DNA sequences

Links

Related Articles

- genome
- plasmid
- *E. coli*
- chromosome
- histone

External links

- Prokaryotic and eukaryotic chromosomes: what's the difference? (<http://vegyeszkar2005.ch.bme.hu/Biomerno ki/Mikrobialisgenetika/nemkotelezo/Drlica.pdf>)

Source

- Genome Packaging in Prokaryotes (<http://www.nature.com/scitable/topicpage/genome-packaging-in-prokaryotes-the-circular-chromosome-9113>)

References

- ALBERTS, B – BRAY, D – JOHNSON, A. *Základy buněčné biologie*. 2. edition. Espero

